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(54) PNEUMATICALLY-OPERATED DISPLACEMENT HAMMER FOR BORING HOLES IN THE GROUND

(71) I, Paul Schmidt, a German citizen, of Reinherstrasse 5940 Lennestadt/Saalhausen, West Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to pneumatically-operated self-propelled displacement hammers for boring holes in the ground.

Such hammers generally comprise a tubular housing which has a percussion boring tool at its front end and contains a pneumatically-operated percussion mechanism which acts on the tool.

A method has already been proposed, wherein, for the purpose, for example, of installing ground anchors, of ground grouting, of constructing wells or of drainage, a follow-up tube which forms a casing in the bored hole can be screwed directly on to the rear end of such a displacement hammer. Further follow-up tubes can, if required, be screwed on to the first one. Since, during the construction of a ground bore hole, the displacement hammer moves forwards jerkily owing to the percussive operation of the hammer, a rupture can occur in the screw-threaded connection between the displacement hammer and a follow-up tube which is screwed to the hammer.

The aim of the present invention therefore is to provide a pneumatically-operated self-propelled displacement hammer for boring holes in the ground, wherein rupture of a screwed connection between the hammer and a follow-up tube is prevented by simple means.

According to this invention, a pneumatically-operated self-propelled displacement hammer for boring holes in the ground comprises a tubular housing having at its rear end a screw-threaded coupling for the connection to the housing of a screw-threaded end of a follow-up tube which, in operation, is drawn behind the hammer into the hole bored by the hammer and forms a casing in the hole, wherein a damping device is provided at the rear end of the housing between the housing and the coupling, the damping device being arranged to damp the transmission of shock waves resulting from operation of the hammer from the housing to the follow-up tube.

By the incorporation of the damping device between the hammer and the follow-up tube screwed to the coupling it is ensured by extremely simple and economic means that the jerky movement of the hammer can no longer act upon the connecting thread to the tube. Instead, the jerky impact movement is effectively damped and thereby damage to the screw threads is prevented. Trouble-free screwing in of one or more follow-up tubes is therefore ensured.

The invention also consists according to another of its aspects in a pneumatically-operated self-propelled percussion boring hammer for boring holes in the ground, the hammer comprising a tubular housing which has a percussion boring tool at its front end and contains a pneumatically-operated percussion mechanism which acts on the tool, the housing having at its rear end a screw-threaded coupling for the connection to the housing of a follow-up tube, which, in operation, is drawn behind the hammer into the hole bored by the hammer and forms a casing in the hole wherein a damping device is provided at the rear end of the housing between the housing and the coupling, the damping device being arranged to damp the transmission of shock waves resulting from operation of the percussion mechanism from the housing to the follow-up tube.

Preferably the damping device comprises two parts which are axially movable relative to one another and elastic elements disposed between these two parts. The function of the elastic elements is to absorb the jerky impact forces. With advantage, one of the two parts is a tubular journal part and the other is a tubular connecting part and has a sleeve-shaped component fixed thereto, the elastic elements being disposed between the internal wall face of the sleeve-shaped com-

ponent and the external peripheral face of the journal part.

In a preferred example, the elastic elements are disposed on both sides of a flange which projects radially from the external peripheral face of the journal part, the external periphery of the flange acting as a guide surface for the internal wall face of the sleeve-shaped component. In this way, firstly satisfactory guiding between the journal part and the connecting part is ensured and secondly it is ensured that the elastic elements come into operation alternately, so that good damping is obtained.

In an especially preferred embodiment of the invention, that end of the sleeve-shaped component which is remote from the connecting part is directed radially inwards on to the external periphery of the journal part. In this way, a limit on the axial movement of the two parts relative to each other is provided in a very simple manner for the associated elastic element, without this requiring an additional stop or abutment.

The fixing of the sleeve-shaped component to the connecting part may be effected by welding, a weld seam between the sleeve-shaped component and the connecting part being situated at a considerable distance from that end of the connecting part which is nearest to the journal part. The advantage of this displaced position of the weld seam is that it is not near to the elastic elements, so that during welding the risk of burning of the elements, which may be in the form of rubber rings, is avoided.

An example of a hammer in accordance with the invention will now be described with reference to the accompanying drawing which is a diametric section through the rear part of the hammer and the damping device.

A damping device 1 comprises a tubular journal part 2, a tubular connecting part 3 and a sleeve-shaped component 5 welded to the connecting part 3 at 4. Between the sleeve-shaped component 5 and the external periphery 6 of the journal part 2, elastic elements 7 in the form of rubber rings are disposed. The elastic elements 7 are situated at a distance from one another and are separated from one another by a flange 8, the external diameter 9 of which is approximately equal to the internal diameter of the sleeve-shaped component 5 and serves for guiding the connecting part 3 on the journal part 2. One elastic element 7 is bounded at its end by the end face of the connecting part 3 and the other elastic element 7 is bounded at its end by a radially inwardly directed end 11 of the sleeve-shaped component 5.

At its outermost end, the connecting part 3 has a screw thread 12 for attachment to the rear end of a displacement hammer indicated in dotted lines at 13. To permit screwing into the rear end of the displacement hammer 13, there are also radial bores 14 in the connecting part 3, intended for receiving a turning tool or key.

For the attachment of a follow-up tube 15, also indicated in dotted lines in the drawing, a coupler 16 is attached to the rear end of the journal part 2. This coupler has an internal screw thread 17 for the attachment of the follow-up tube 15. The coupler 16 is connected to the journal part 2 by an adhesive over an area 18. Radial bores 19, for the insertion of a tool or key, are likewise used for screwing the coupler 16 on to the follow-up tube 15, fitted with a corresponding thread.

In use, the connecting part 3 of the damping device 1 is screwed into the rear end of the displacement hammer 13. The follow-up tube 15 is then screwed into the thread 17 of the coupler 16. The pneumatically driven displacement hammer 13 is then ready for operation. During the jerky forward movement of the displacement hammer 13, the shock waves are absorbed by the elastic elements 7, since the connecting part 3 together with the displacement hammer 13 executes the sudden movement, whereas the journal part 2 and the coupler 16 remain behind together with the follow-up tube 15 on account of their large inertia, so that a relative movement occurs between the two groups of components. As a consequence of this relative axial movement, the elastic elements 7 situated to the right side of the flange 8 are compressed by the radially inwardly directed end 11 of the sleeve-shaped component 5 and thus the impact forces which occur in the one direction of movement are absorbed, so that these forces cannot act upon the screw thread between the coupler 16 and the follow-up tube 15. In the opposite direction of movement, the damping element 7 to the left of the flange 8 comes into operation.

The elastic elements 7 may also be formed other than as rubber rings, for example as rubber blocks distributed around the circumference of the part 2. In essence, the entire damping device 1 may be incorporated integrally into the damping hammer 13. To do this, the housing of the displacement hammer 13 has to be made longer and a component acting as a seating or attachment for the follow-up tube has to be provided at the rear end of the housing and be movable relative thereto, the elastic elements being incorporatd between these two parts.

WHAT I CLAIM IS:—

1. A pneumatically-operated self-propelled displacement hammer for boring holes in the ground, the hammer comprising a tubular housing having at its rear end a screw-

threaded coupling for the connection to the housing of a screw-threaded end of a follow-up tube which, in operation, is drawn behind the hammer into the hole bored by the hammer and forms a casing in the hole, wherein a damping device is provided at the rear end of the housing between the housing and the coupling, the damping device being arranged to damp the transmission of shock waves resulting from operation of the hammer from the housing to the follow-up tube.

2. A pneumatically-operated self-propelled percussion boring hammer for boring holes in the ground, the hammer comprising a tubular housing which has a percussion boring tool at its front end and contains a pneumatically-operated percussion mechanism which acts on the tool, the housing having at its rear end a screw-threaded coupling for the connection to the housing of a follow-up tube, which, in operation, is drawn behind the hammer into the hole bored by the hammer and forms a casing in the hole wherein a damping device is provided at the rear end of the housing between the housing and the coupling, the damping device being arranged to damp the transmission of shock waves resulting from operation of the percussion mechanism from the housing to the follw-up tube.

3. A hammer according to claim 1 or claim 2, in which the damping device comprises two parts which are axially movable relative to one another and elastic elements disposed between these two parts.

4. A hammer according to Claim 3, in which one of the two parts is a tubular journal part and the other is a tubular connecting part and has a sleeve-shaped component fixed thereto, the elastic elements being disposed between the internal wall face of the sleeve-shaped component and the external peripheral face of the journal part.

5. A hammer according to claim 4, in which the elastic elements are disposed on both sides of a flange which projects radially from the external peripheral face of the journal part, the external periphery of the flange acting as a guide surface for the internal wall face of the sleeve-shaped component.

6. A hammer according to claim 4 or claim 5, in which that end of the sleeve-shaped component which is remote from the connecting part is directed radially inwards on to the external periphery of the journal part.

7. A hammer according to any one of claims 4 to 6, in which the sleeve-shaped component is welded to the connecting part.

8. A hammer according to claim 7 in which a weld seam between the sleeve-shaped component and the connecting part is spaced away from that end of the connecting part which is adjacent the journal part.

9. A hammer according to any one of claims 4 to 8, in which the connecting part has a screw thread, which is screwed to the housing, at its end remote from the journal part.

10. A hammer according to any one of claims 4 to 9, in which the coupling is fixed by an adhesive to the journal part.

11. A hammer according to any one of the preceding claims, in which the elastic elemetns are rubber rings.

12. A hammer according to claim 1, in which the damping device is substantially as described with reference to the accompanying drawing.

For the Applicant:—
GILL, JENNINGS & EVERY,
Chartered Patent Agents,
53/64 Chancery Lane,
London, WC2A 1HN.

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1 SHEET This drawing is a reproduction of the Original on a reduced scale